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(54) SURGICAL PLASTER

(71) We, JOHNSON & JOHNSON, a Corporation organised under the laws of the State of New Jersey, United States of America, of 501 George Street, New Brunswick, State of New Jersey, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to surgical plaster.

Surgical plasters comprising an elastic woven fabric backing material and a pressure-sensitive adhesive coated thereon have been known for many years. By "pressure-sensitive adhesive" we refer in this context, of course, to adhesives effective and acceptable on human skin. They can be used in the form of adhesive tapes for application to various parts of the body, sometimes to bind dressing material already applied to the body. It is also well-known to apply dressing pads to strips of such adhesive tape so as to provide first-aid plasters for application to wounds.

The elastic woven fabric backing material has a weft of high-twist (alternating S and Z twist) cotton yarn and a warp comprising cotton or rayon staple or cotton and rayon fibre spun together. The high-twist yarn imparts elasticity to the plaster in the weft direction, but the staple rayon or cotton fibre affords substantially no elasticity in the warp direction, thus limiting the conformability of the fabric. This is a serious disadvantage when the plaster is placed on body joints where stretch and recovery properties are required in both the lateral and longitudinal directions.

Another disadvantage is that the woven fabric frays badly when cut. Accordingly it has been necessary to produce the fabric in the various widths required for use as plaster. A further disadvantage of such plasters is that they are somewhat bulky.

The present invention provides surgical plaster comprising a pressure-sensitive adhesive coated on a warp-knitted fabric backing material made with at least one extensible yarn and extensible in at least one direction. Preferably the fabric comprises at least two extensible yarns. By "extensible" we mean extensible in the fabric.

Surgical plaster in accordance with the present invention has a better range of conformability and less bulk than the known surgical plasters referred to above, and as the warp-knitted fabric exhibits substantially no fraying when cut, webs or sheets of the fabric can be cut into the sizes required for use as surgical plaster.

In one embodiment of the present invention, the plaster is intended for use in the preparation of first-aid plasters. According to this embodiment the fabric is extensible in both the longitudinal and lateral directions. Preferably the extensibility in the lateral direction is greater than the extensibility in the longitudinal direction.

According to this embodiment, one extensible yarn is preferably a nylon yarn, e.g. a flat nylon yarn, which in the fabric is mechanically distorted by the warp knitting process to give the desired properties of extension and recovery to the fabric. These properties are preferably in the range 110% to 160% longitudinal extension, (viz 1 inch extends to 1.1 inches for a 110% extension), and 150% to 300% in the lateral direction. Preferably recovery should be greater than 85% in the longitudinal direction, and greater than 60% in the lateral direction. The extensible nylon yarn is preferably from 15-400 denier, e.g. 20 denier.

Other extensible yarns are those comprising mono-filaments or multi-filaments of nylon 6 or nylon 66, polyester, polyacrylate, polyvinyl alcohol or polyurethane. A preferred multi-filament yarn is from 10-100 denier, e.g. 70 denier.

The warp-knitted fabric may comprise one warp in the repeat pattern but preferably it comprises two or more warps, for example three, four or five warps. Usually it will consist of two warps, each of which comprises an extensible yarn which are preferably different but which can be the same. When more than one warp yarn is employed in the fabric, it is not necessary for all the warp yarns to be extensible, provided at least one of them is extensible.

The warp-knitted fabric may be produced, for example, on "Rachelle" and "Tricot" knitting machines, which are well known in the art. We prefer to use "Rachelle" knitting machines because a wider range of stitches, for example, reverse locknit, semi-satin, and two-bar atlas, and a more controllable tension, can be produced.

According to another embodiment of the present invention the plaster is intended for use, per se, as a surgical bandage. In such a bandage, lateral or sideways extensibility may not be desirable, although longitudinal extensibility is still required. The knitter can ensure that the extensibility in the sideways direction is at a desired minimum because of the mechanical distortion to which the yarn(s) is/are subjected.

Preferably one extensible yarn in the fabric is an elastic, e.g. elastomeric yarn, such as polyurethane yarn, e.g. "Lycra" or "Spanzelle" yarn (*registered Trade Marks). The elastic yarn, which has the properties of extension and recovery, is preferably from 20 to 400 denier, e.g. 250 denier.

It will be appreciated by the skilled warp-knitter that the extensibility of the plaster in the lateral direction is controlled, inter alia, by the nature of the extensible yarns and the knitting tensions. The stretch and recovery properties may be altered at will since the inherent stretch of the yarns may be increased or reduced by the way in which those yarns are knitted into the fabric. Thus any desired extension and recovery characteristics may be achieved, permitting the avoidance of strangulation in use, which is particularly desirable with elastic fabric bandages.

A commercial example of a yarn whose inherent stretch may be increased by the way in which it is knitted into the fabric is the knit/de-knit texturised yarn. The knit/de-knit process consists of knitting, followed by a heat-setting process, and then by an unravelling process.

One example of a bandage according to the present invention comprises four yarns namely, (a) a flat nylon monofilament, preferably in the range 5 to 200 denier, e.g. 20 denier, (b) a flat multi-filament nylon yarn in the range 5 to 200 denier, e.g. 30 denier,

(c) an elastic polyurethane, e.g. "Lycra", yarn in the range 20 to 400 denier, e.g. 70 denier, and (d) a nylon yarn which is wrapped around yarn (c) to avoid slipping of the elastic yarn in the fabric. The knitter can ensure that the fabric has no, or substantially no, extensibility in the sideways direction, in spite of the inherent extensibility of the yarn.

The warp knitted fabric may be coated with conventional rubber-resin adhesives, by polyvinyl ether adhesives, or by acrylate adhesives. Acrylate adhesives have the advantage of hypo-allergenic properties, and are less painful on removal from the skin. This feature is most important in elastic adhesive bandages where the bandage is often in place for several days before removal.

A preferred embodiment of surgical plaster in accordance with the present invention for use as first-aid plasters will now be described by way of example.

Example

A warp-knitted fabric was produced on a "Rachelle" knitting machine using 20 denier monofilament nylon yarn in combination with 70 denier mechanically distorted (prior to knitting) multi-filament nylon yarn. The latter yarn may be mechanically distorted prior to knitting by spinning the nylon yarn, wrapping it around a rotating mandrel, and heat-setting. This process has the advantage of distorting every single portion of the nylon fibre. The combination of the two yarns in a reverse locknit stitch, produced a fabric which was extensible in the longitudinal and lateral directions, the extensibility in the lateral direction being the greater.

The fabric was coated with a pressure-sensitive adhesive, and then cut into webs which were used to produce first-aid plasters. The plasters had excellent conformability in both the longitudinal and lateral directions in use, did not fray on being cut, and further were less bulky than conventional woven fabric surgical plasters. If desired the fabric may be cut up into webs before being coated with adhesive.

WHAT WE CLAIM IS:

1. Surgical plaster comprising a pressure-sensitive adhesive coated on a warp-knitted fabric backing made with at least one extensible (as herein defined) yarn and extensible in at least one direction.

2. Surgical plaster according to Claim 1 wherein said fabric is extensible in the longitudinal and lateral directions.

3. Surgical plaster according to Claim 1 or 2, wherein the extensibility in the lateral direction is greater than the extensibility in the longitudinal direction.

4. Surgical plaster according to any one of Claims 1 to 3, wherein the fabric has a longitudinal extensibility of 110 to 160 per cent and a lateral extensibility of 150 to 300 per cent.
5. Surgical plaster according to any one of Claims 1 to 4, wherein the fabric comprises two extensible yarns.
6. Surgical plaster according to any one of Claims 1 to 5, wherein the extensible yarn comprises mono-filaments or multi-filaments of nylon, polyester, polyacrylate, or polyurethane.
7. Surgical plaster according to Claim 6, wherein the nylon yarn is flat nylon yarn.
8. Surgical plaster according to Claim 6 or 7, wherein the nylon yarn is from 15 to 400 denier.
9. Surgical plaster according to Claim 6, wherein the multi-filament yarn is from 10 to 100 denier.
10. Surgical plaster according to Claim 1, wherein the fabric has no, or substantially no, extensibility in the lateral direction.
11. Surgical plaster according to Claim 1 or 10, comprising at least one elastic yarn.
12. Surgical plaster according to Claim 11, wherein the elastic yarn is an elastomeric yarn.
13. Surgical plaster according to Claim 12, wherein the elastomeric yarn is a polyurethane yarn.
14. Surgical plaster according to any one of Claims 11 to 13 wherein the elastomeric yarn is from 20 to 400 denier.
15. Surgical plaster according to any one of Claims 10 to 14 comprising the four yarns (a) to (d) as hereinbefore defined.
16. A first-aid plaster comprising the surgical plaster of any one of Claims 1 to 9.
17. A surgical bandage comprising the surgical plaster of any one of Claims 10 to 15.
18. Surgical plaster according to any one of Claims 1 to 17 wherein the fabric is produced on a "Rachelle" knitting machine.
19. Surgical plaster according to any one of claims 1 to 18 wherein the pressure-sensitive adhesive is an acrylate adhesive.
20. Surgical plaster in accordance with Claim 1 substantially as hereinbefore described.
21. Surgical plaster substantially as hereinbefore described with reference to the Example.
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